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(54) Press section with an equalizing press in a paper machine

(57) The invention concerns a press section in a paper machine, through which press section the paper web (W) has a closed and supported draw. The press section comprises at least two successive separate press nips (NP_1,NP_2,N_3; NP_3), dewatering of the paper web (W) being carried out at least in the first one of said press nips, preferably between two press fabrics (20,30) that receive water. The last press nip (N_3;NP_3) in the press section is an equalizing press nip (N_3;NP_3), which is separate from the preceding nip (NP_2) and in which no substantial dewatering is performed. The paper web (W) is passed through the equalizing press nip (N_3;NP_3) from the preceding dewatering press nip (NP_2) on a transfer belt (50) substantially not receiving water, on its substantially straight run. This run is continued after the equalizing nip (N_3,NP_3) as a run (50a) of substantially the same direction, on which run, by means of the difference in speed of the transfer belt (50), if necessary, some of the elongation of the paper web (W) in the machine direction is compensated for, which elongation takes place in the equalizing nip (N_3,NP_3).

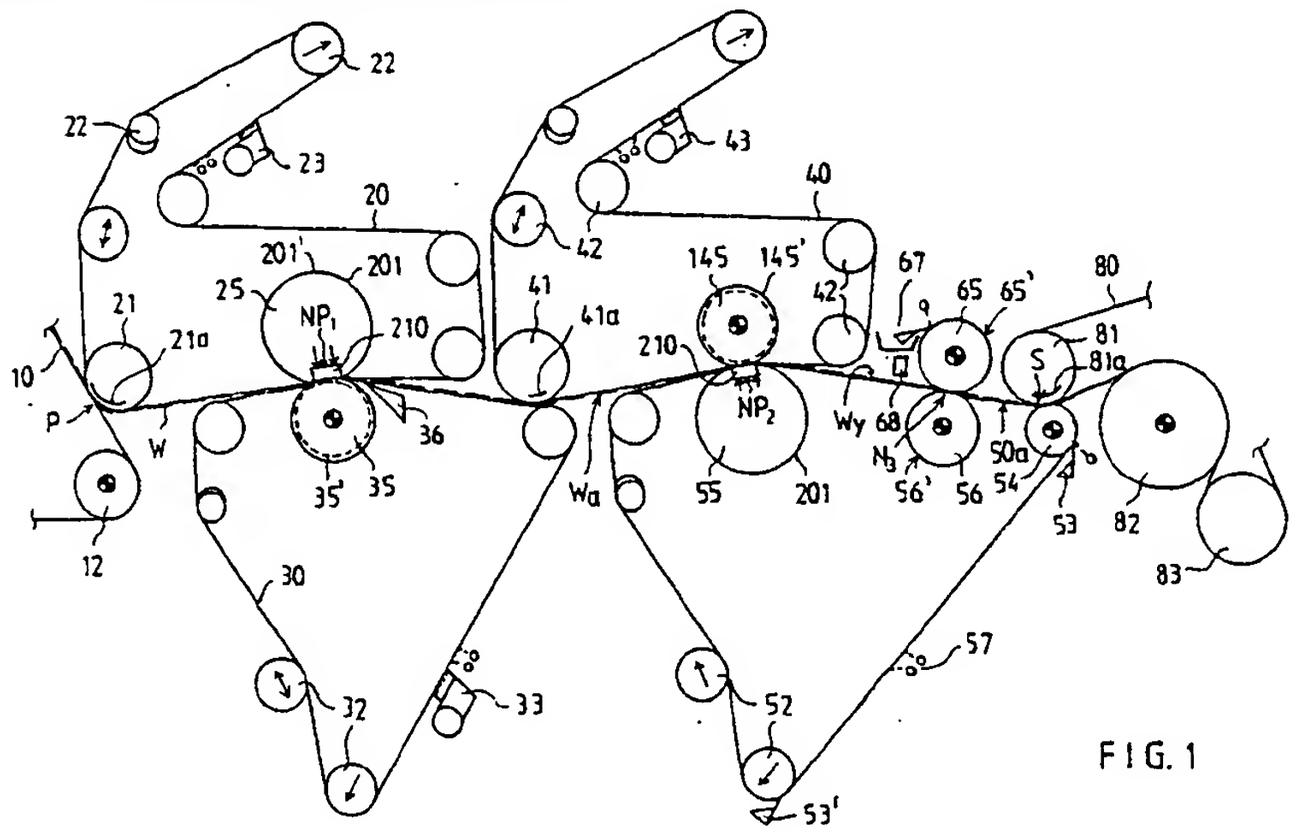

FIG. 1

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Description

The invention concerns a press section in a paper machine, through which press section the paper web has a closed and supported draw and which press section comprises at least two successive separate press nips, dewatering of the paper web being carried out at least in the first one of said press hips, preferably between two press fabrics that receive water.

One of the most important quality requirements of all paper and board grades is uniformity of the structure both on the micro scale and on the macro scale. The structure of paper, in particular of printing paper, must also be symmetric. The good printing properties required from printing paper mean equal good smoothness, evenness, and certain absorption properties of both faces. The properties of paper, such as the symmetry of surface roughness and density, are affected to a considerable extent by the operation of the press section of the paper machine, which operation also has a decisive significance for the uniformity of the profiles of the paper in the cross direction and in the machine direction.

Increased running speeds of paper machines create new problems to be solved, which problems are mostly related to the runnability of the machine. Currently, running speeds of up to about 1500 metres per minute are employed. At these speeds, so-called closed press sections, which comprise a compact combination of press rolls fitted around a smooth-faced centre roll, usually operate satisfactorily. As. examples of such press sections should be mentioned the applicant's **"Sym-Press II"™** and **"Sym-Press 0"™** press sections.

From the point of view of energy economy, dewatering taking place by pressing is preferable to dewatering taking place by evaporation. This is why attempts should be made to remove a maximal amount of water out of the paper web by pressing in order that the proportion of water to be removed by evaporation could be made as little as possible. Increased running speeds of paper machines, however, create new, so far unsolved problems expressly for the dewatering taking place by pressing, because the press impulse cannot be increased sufficiently by the means known from the prior art, above all because at high speeds the nip times remain inadequately short and, on the other hand, the peak pressure of pressing cannot be increased beyond a certain limit without destruction of the structure of the web.

In the prior-art press sections, the single-felt last press nip tends to produce a poor symmetry of roughness, in particular with fine paper and with LWC and MWC base paper. The problem is emphasized when the press impulse is high, as is the case with an extended-nip press in the last press position. For example, with MWC base paper, with the applicant's test paper machine, when non-calendered, for top-face/bottom-face Bendtsen roughness the value 0.52 was obtained, when the press load was 800 kN per metre in a "Sym-Belt S" ™ press, the length of the press shoe was 152 mm, and the smooth press roll was in the upper position of the single-felt press nip. Said high asymmetry of roughness constitutes a limitation for the extent of press load, for the dry solids content that can be achieved, and for the wet strength.

A typical environment of application of the present invention, to which environment the present invention is, however, not supposed to be restricted, is represented by the applicant's **FI Patent Application 905798** (filed Nov. 23, 1990) and by equivalent **US Patent Applications 07/795,043 and 08/026,851**.

It is known from the prior art to employ so-called equalizing presses in connection with various press sections, including extended-nip press sections, by means of which equalizing presses attempts are made to equalize the above asymmetry of roughness. With respect to these prior-art equalizing presses, reference is made, for example, to the **applicant's FI Patent 64,823**, to **the published DE Patent Application 4,321,406 A1 of Messrs. J.M. Voith GmbH**, and to **the DE Utility Model G 9,206,340.3 of Messrs. Sulzer-Escher Wyss GmbH**. By means of the equalizing presses known from the papers mentioned above, it has, however, not been possible to solve the problems related to asymmetry of roughness in a satisfactory way, in particular not in connection with a supported transfer of the web. Of the cited papers mentioned above, said DE Utility Model is most closely related to the present invention, in particular the embodiment illustrated in Fig. 12 in said paper. In the equalizing press illustrated in said Fig. 12, the lower press roll 11 in the equalizing press 5/11 curves the transfer belt 12 and the web over a considerably large angle, and moreover, in connection with the same lower press roll 11, a web transfer nip has been formed by means of a suction roll. Thus, in said construction, it is impossible to make use of differences in speed, by whose means it would be possible to tighten the web after the equalizing press 5/11 so as to eliminate the effects of elongation of the web taking place in said equalizing press. Moreover, in said construction, the abrupt angle of change in direction in a sensitive area directly after the equalizing press restricts the speed of operation of the press.

Thus, the object of the present invention is avoiding of these drawbacks and further development of the prior art most closely related to the present invention.

In view of achieving the objectives stated above and those that will come out later, the invention is mainly characterized in that the last press nip in the press section is an equalizing press nip which is separate from the preceding nip and in which no substantial dewatering is performed, that the paper web is passed through the equalizing press nip from the preceding dewatering press nip on a transfer belt substantially not receiving water, on its substantially straight run, which is continued after the equalizing nip as a run of substantially the same direction, on which run, by means of the difference in speed of the transfer belt, it is possible to compensate for some of the elongation of the paper web in the

machine direction, which elongation takes place in the equalizing nip.

In the invention, the web is transferred from the last dewatering nip in the press section, preferably an extended nip, on a transfer belt as a linear run through the equalizing press so that the joint run of said transfer belt and the web continues as a substantially straight run also after the equalizing nip. On this straight run of the transfer belt and the web after the equalizing nip, the transfer belt can be extended to some extent so that the elongation of the web taking place in the equalizing press can be compensated for and the web can be kept tight and reliably in contact with the transfer belt. On the straight run of the transfer belt and the web, a convex suction-transfer sector can also be arranged favourably, on which sector the web can be transferred reliably onto the drying wire of the dryer section of the paper machine while using a minimal angle of change in direction.

In the preferred embodiment of the invention, in the equalizing press a particular equalizing-band loop is employed, by means of whose surface and elasticity properties it is possible to optimize the operation of the equalizing press and to make sure that, after the equalizing press, the web follows the same transfer band on which it was brought into the equalizing press and passed through the press as a run as straight as possible.

In the following, the invention will be described in detail with reference to some exemplifying embodiments of the invention illustrated in the figures in the accompanying drawing, the invention being by no means strictly confined to the details of said embodiments.

Figure 1 is a schematic side view of a press section which is provided with a supported transfer of the web and with an equalizing press of roll nip type.

Figure 2 is an illustration similar to Fig. 1 of a press section in accordance with the invention in which, compared with Fig. 1, additionally a press belt runs through the equalizing press of roll nip type.

Figure 3A is an illustration similar to Figs. 1 and 2 of a press section in accordance with the invention in which there is an extended-nip press as the equalizing press.

Figure 3B shows a modification of the extended-nip equalizing press of a press section as shown in Fig. 3A.

Figure 4A shows such a variation of the press section as shown in Fig. 3 in which the extended-nip press that operates as an equalizing press is provided with a separate press-belt loop.

Figure 4B shows a modification of the extended-nip equalizing press of a press section as shown in Fig. 4A.

Figure 5 shows a solution alternative to Figs. 1...4 for passing the web from the transfer belt to the dryer section.

To begin with, the common prior-art features of construction of the press section geometries as shown in Figs. 1...4 will be described. According to Figs. 1...4, with the closed draw of the web W in the paper or board machine, the press section comprises a first upper fabric 20 which receives water, onto which fabric the web W is transferred on the suction zone 21a of the pick-up roll 21 at the pick-up point P from the forming wire 10, whose return run starts from the wire drive roll 12. According to Figs. 1...4, in the press, there are two successive press nips NP_1 and NP_2, which dewater the web W efficiently and between which the web W has a fully closed almost linear draw so that it is all the time supported by a fabric. Both of said nips NP_1 and NP_2 are so-called extended nips, whose press zone is substantially longer than that of a normal sharp roll nip.

In Figs. 1...4, the first upper fabric 20 is guided by alignment, tensioning and guide. rolls 22 and conditioned by conditioning devices 23. The first extended nip NP_1 includes a water-receiving lower fabric 30, which is guided by alignment, tensioning and guide rolls 32 and conditioned by conditioning devices 33. The first extended nip NP_1, and so also the second extended nip NP_2, are accomplished, for example, by means of the applicant's **"Sym Belt Press"™** press, the details of whose construction come out, for example, from Fig. 10 in the applicant's **FI Patent Application 905798**. As regards its principal features, the construction of the press is such that the extended nip NP_1 is composed of a flexible hose mantle 201 and of a back-up roll 35. Inside the hose mantle 201, which is preferably hollow-faced 201' inside the dewatering-fabric loop 20, there is a hydrostatically and/or hydrodynamically lubricated glide shoe 210, and the hydraulic loading means fitted in connection with said glide shoe press the glide shoe 210 against the hollow-faced 35' back-up roll 35. The back-up roll 35 is a hollow-faced 35' press roll, for example the applicant's adjustable-crown **"Sym-Z Roll"™**.

According to Figs. 1...4, the press section includes a second upper fabric 40, onto which the web W is transferred as a closed, substantially linear draw by means of the suction zone 41a of the suction roll 41. After the first nip NP_1, it is ensured that the web W follows the first lower fabric 30 by means of a suction box 36 or by means of an equivalent foil arrangement. The second upper fabric 40 is guided by alignment, tensioning and guide rolls 42 and conditioned by conditioning means 43.

In the second extended nip NP_2, the extended-nip roll 55 is placed underneath inside the loop of the transfer belt 50, and the upper back-up roll is a hollow-faced 145' variable-crown press roll 145, which is placed inside the loop of the second upper press fabric 40. The belt mantle 201 of the extended-nip roll 55 may also be hollow-faced, and a hollow face is preferable especially in connection with a slightly permeable transfer belt 50. In the invention, the transfer belt 50 runs through the last dewatering press nip NP_2 and through the equalizing press nip N_3,NP_3 as an almost straight run. The transfer belt 50 is guided by guide and tensioning rolls 52 and by a drive roll 54 as well as conditioned by doctors 53 and 53' and by wash jets 57.

According to the invention, after the last extended nip NP_2, in connection with the transfer belt, an equalizing nip N_3;NP_3 is arranged, after which the web W is passed as an almost linear closed draw on the transfer

belt 50 to the transfer point S and further onto the drying wire 80. Since, in the last extended nip NP_2, the lower element is a relatively smooth transfer belt 50 which does not receive water to a substantial extent, and the upper element is a "rougher" press fabric 40 that receives water, such as a press felt, after the nip NP_2 the roughness of the upper face W_y of the web W unavoidably becomes substantially higher than the roughness of the lower face W_a. The difference in roughness is equalized by means of an equalizing nip N_3;NP_3 in accordance with the invention by pressing the top side W_y of the web W against a smooth face 65';60;201.

According to Fig. 1, the equalizing press nip N_3 is formed between an upper smooth-faced 65' press roll 65 and a lower smooth-faced or hollow-faced 56' press roll 56. The surface energy and the adhesion of the smooth face 65' of the upper roll 65 have been chosen considerably lower than those of the outer face of the transfer belt 50, so that the web W follows the transfer belt 50 after the nip N_3. For cleaning of the smooth-faced upper roll 65 and for removal of broke, a doctor, a wash jet and a broke trough 67 are used. The press roll 65 may be heated by means of prior-art heating devices 68, examples of which include inside steam heating, hot-water heating through a drilled roll mantle, and outside infrared or induction heating. The elevated temperature of the face of the press roll 65 intensifies the smoothing of the roughness of the face of the web W that is placed at the side of said roll.

The equalizing press nip N_3 shown in Fig. 2 is also of the roll type. Through the nip N_3, at the top, a particular non-permeable equalizing belt 60 that does not receive water has been arranged to run, the outer face of which belt is quite smooth. The equalizing belt 60 is guided by alignment and tensioning rolls 61 and by guide rolls 62. The surface energy of the outer face of the equalizing belt 60 and the adhesion of said face to the web W are lower than those of the outer face of the transfer belt 50, so that after the nip N_3 the web W follows the transfer belt 50. For cleaning of the equalizing belt 60 and for removal of broke, a doctor, a wash jet and a broke trough 67 as well as the doctor and the trough 67' of the guide roll 62 are used. The surface temperature of the equalizing belt 60 can also be raised, for example, by means of an infrared heater 68'.

In Fig. 3A, the equalizing press nip NP_3 placed after the press nip NP_2 is of the extended-nip type. The extended nip NP_3 is formed between the upper extended-nip roll 165 and the lower smooth-faced 56' press roll 56. The extended-nip zone is formed between the press shoe 210 and the roll face 56'. In the roll 165, there is a hose mantle 201 provided with a smooth outer face, whose surface energy is lower than that of the outer face of the transfer belt 50, so that, after the equalizing step taking place in the nip NP_3, the web W follows the lower transfer belt 50. For cleaning of the hose mantle 201 and for removal of broke, a doctor, a wash jet and a broke trough 67 are used. The surface temperature of the hose mantle 201 can also be raised, for example, by means of an infrared heater 68'.

Fig. 3B shows a modification of the equalizing press nip NP_3 shown in Fig. 3A. The equalizing nip NP_3 shown in Fig. 3B differs from the corresponding equalizing press nip NP_3 shown in Fig. 3A in the respect that, in Fig. 3B, the extended-nip roll 165 provided with a hose mantle 201 is placed underneath, i.e. inside the loop of the transfer belt 50, and the smooth-faced 56' "rigid" press roll 56 is placed above. The upper press roll 56 is provided with an infrared heater 68', a doctor, a wash jet, and with a broke trough 67 placed in their connection.

In Fig. 4A, the equalizing press nip NP_3 is also of the extended-nip type. In the nip NP_3, the lower roll 155 is a roll provided with a smooth hose mantle 201, and the upper roll is a smooth-faced 65' press roll 65, around which, additionally, an equalizing belt 60 similar to that described above and running through the nip NP_3 is fitted. The equalizing belt 60 is guided by guide rolls 62 and by alignment and tensioning rolls 61. The smooth outer face of the equalizing belt 60 has a surface energy lower than that of the outer face of the transfer belt 50, so that after the nip NP_3 the web W follows the transfer belt 50. For cleaning of the equalizing belt 60 and for removal of broke, a doctor, a wash jet, and a broke trough 67 are used. Also on the guide roll 62, there is a doctor and a trough 67' in its connection.

Fig. 4B shows a modification of the extended-nip equalizing press NP_3 shown in Fig. 4A. Fig. 4B differs, in respect of the extended nip NP_3, from the corresponding extended nip shown in Fig. 4A in the respect that, in Fig. 4B, the lower press component is a smooth-faced 65' "rigid" press roll 65, which is, thus, placed inside the transfer-belt loop 50. The upper press component in the equalizing press nip NP_3 is an extended-nip roll 155 provided with a smooth hose mantle 201, around which roll an equalizing belt 60 runs, which has been arranged in a way similar to Fig. 4A and whose latter guide roll 62a is preferably a driven roll.

After the third nip N_3;NP_3, the web W is transferred on the lower fabric 50 onto the concave transfer sector S, where there is the suction zone 81a of the suction roll 81, with whose aid the web W is transferred as a closed and substantially straight draw onto the drying wire 80.

In the equalizing press N_3;NP_3 fitted in accordance with the present invention, it is a substantially novel feature that, after the equalizing press N_3;NP_3, the transfer belt 50 runs as a considerably long straight run 50a onto the transfer-belt drive roll 54. In the figures, the most essential drive points of various rolls are indicated. There may also be other drive points, for example for the pick-up roll and the transfer-suction roll. By means of regulation of the speed of the drive of the drive roll 54, it is possible to stretch the portion 50a of the transfer belt 50 placed between the equalizing nip N_3;NP_3 and the drive roll 54 so that the elongation of the web W taking place in the transfer nip N_3;NP_3 can be compensated for and the run of the web W be kept tight after the equalizing nip N_3. Said straight joint run 50a of the transfer belt 50

and the web W also provides the advantage that on said run it is possible to arrange a concave suction-transfer zone S, on which the web W is transferred reliably and along an almost linear path onto the drying wire 80. The effect of the equalizing press on equalization of the roughness of the web W can also be regulated by means of hardnesses of the faces that press the web W. The ability of a harder material to reduce roughness is better than that of a softer material.

As comes out from the above, the web W has a closed and supported draw when it moves from the pick-up point P of the forming wire 10 to the point S, where it is transferred onto the drying wire 80 of the dryer section and further as a supported single-wire draw at least through the first dryer group. The circumstance that, after each nip, the web W follows the fabric that is supposed to carry the web further is ensured by means of various suction or foil devices, by means of covering angles of the press fabrics, and/or by means of the adhesion properties of the fabrics. Of these devices, the suction boxes 36 are shown in the figures.

Fig. 5 shows an advantageous solution, alternative to Figs. 1...4, for passing the web W after the equalizing press nip N_3 from the transfer belt 50 onto the drying wire 80 of the dryer section and on said wire further through the first group with single-wire draw in the dryer section. Fig. 5 shows an embodiment in connection with an equalizing nip N_3 as shown in Fig. 1, but it should be emphasized that a closed draw of the web W as shown in Fig. 5 is equally well suitable for use in the press sections shown in Figs. 2, 3 and 4.

According to Fig. 5, after the equalizing nip N_3, the transfer belt 50 is passed over the driven guide roll 54a. The drying wire 80 is guided by means of a guide roll 85 of adjustable position (arrow V) so that it contacts the guide roll 54a and the web W placed on said guide roll within the transfer sector α. On the transfer sector α the drying wire 80 presses the web W against the guide roll 54a, whereby the web W is transferred reliably to the more adhesive drying wire 80 and is separated from the transfer belt 50. After the transfer sector α the drying wire 80 and the web W are passed over the reversing cylinder 83a, preferably a suction cylinder marketed by the applicant under the trade mark VAC-ROLL™. The grooved outer mantle face 84 of the reversing cylinder 83a is subjected to a vacuum. In order to prevent pressures induced in the closing nip space NC between the reversing cylinder 83a and the drying wire 80 after the transfer sector α, in said nip space NC a blow box 86 is fitted which produces a vacuum, for example a blow box marketed by the applicant under the trade mark UNO RUN BLOW BOX™ or equivalent. The magnitude of the transfer sector α is preferably arranged adjustable by changing the position of the guide roll 85 (arrow V). In the threading position, the magnitude of the sector α is, as a rule, chosen in the range of $\alpha \approx 5...45°$, and during constant running $\alpha \approx 0...15°$. The transfer of the guide roll 85 can be arranged in a way in itself known, for example, by means of hydraulic or pneumatic cylinders.

From Figs. 1...4 it can be concluded directly that the run of the web W to be pressed through the press section is highly linear without major bends. Owing to the almost linear path of running of the web, the dynamic forces applied to the web remain sufficiently low in view of minimizing the risk of breaks. The magnitude of an angle of change in direction of the web W is in preferred embodiments in the range of 5...30° and, as a rule, < 15°. An exception from this may be constituted by the pick-up roll 21 and by its suction zone, in which even a high vacuum can be employed locally.

In the press constructions described above, an almost linear closed draw of the paper web W is accomplished so that it has been possible to minimize the dynamic forces applied to the web W and the risks of breaks. Thus, the runnability is satisfactory even at high speeds (30...40 metres per second). Moreover, by using extended nips NP_1 and NP_2 provided with hose rolls in the press section in accordance with the present invention, it has been possible to guarantee an adequate dewatering capacity and dry solids content even at high speeds without applying pressing stages of excessively high peak pressures to the web W.

The invention can also be applied to other press sections provided with supported transfer of the web, besides those described above by way of example. One alternative environment of application of the invention is, for example, the press section marketed with the trade mark **"Center-Belt"™**.

In the following, the patent claims will be given, and the various details of the invention may show variation within the scope of the inventive idea defined in said claims and differ from what has been stated above by way of example only.

The invention concerns a press section in a paper machine, through which press section the paper web (W) has a closed and supported draw. The press section comprises at least two successive separate press nips (NP_1,NP_2,N_3; NP_3), dewatering of the paper web (W) being carried out at least in the first one of said press nips, preferably between two press fabrics (20,30) that receive water. The last press nip (N_3;NP_3) in the press section is an equalizing press nip (N_3;NP_3), which is separate from the preceding nip (NP_2) and in which no substantial dewatering is performed. The paper web (W) is passed through the equalizing press nip (N_3;NP_3) from the preceding dewatering press nip (NP_2) on a transfer belt (50) substantially not receiving water, on its substantially straight run. This run is continued after the equalizing nip (N_3,NP_3) as a run (50a) of substantially the same direction, on which run, by means of the difference in speed of the transfer belt (50), if necessary, some of the elongation of the paper web (W) in the machine direction is compensated for, which elongation takes place in the equalizing nip (N_3,NP_3).

Claims

1. A press section in a paper machine, through which press section the paper web (W) has a closed and supported draw and which press section comprises at least two successive separate press nips (NP_1,NP_2,N_3;NP_3), dewatering of the paper web (W) being carried out at least in the first one of said press nips, preferably between two press fabrics (20,30) that receive water, **characterized** in that the last press nip (N_3;NP_3) in the press section is an equalizing press nip (N_3;NP_3) which is separate from the preceding nip (NP_2) and in which no substantial dewatering is performed, that the paper web (W) is passed through the equalizing press nip (N_3;NP_3) from the preceding dewatering press nip (NP_2) on a transfer belt (50) substantially not receiving water, on its substantially straight run, which is continued after the equalizing nip (N_3,NP_3) as a run (50a) of substantially the same direction, on which run, by means of the difference in speed of the transfer belt (50), it is possible to compensate for some of the elongation of the paper web (W) in the machine direction, which elongation takes place in the equalizing nip (N_3,NP_3).

2. A press section as claimed in claim 1, **characterized** in that, on the straight run (50a) of the transfer belt (50) and the paper web (W) after the equalizing nip (N_3,NP_3), a transfer sector (S) that is concave in relation to the paper-side face of the transfer belt has been arranged before the transfer-belt drive roll (54), on which transfer sector (S) the paper web (W) is transferred from the transfer belt (50) onto the drying wire (80) of the dryer section while using a minimal turning angle.

3. A press section as claimed in claim 1 or 2, **characterized** in that the equalizing nip (N_3) is formed between two smooth-faced (56',65') press rolls (56,65) (Fig. 1).

4. A press section as claimed in any of the claims 1 to 3, **characterized** in that an equalizing-band loop (60) is fitted to run through the equalizing nip (N_3) at the side of the rougher face (W_y) of the paper web (W), which band loop (60) is guided by guide and tensioning rolls (61,62) (Fig. 2).

5. A press section as claimed in claim 1 or 2, **characterized** in that the equalizing press is an extended-nip press (NP_3) (Figs. 3A,3B and 4A,4B).

6. A press section as claimed in claim 5, **characterized** in that the extended-nip equalizing press (NP_3) is composed of a smooth-faced hose roll (165) fitted at the side of the rougher face (W_y) of the paper web (W) and loaded by a press shoe or a series of press shoes (210) and of a press roll (56) that is fitted inside the transfer-belt loop (50) opposite to said hose roll (165) (Fig. 3A).

7. A press section as claimed in claim 5, **characterized** in that the extended-nip equalizing press (NP_3) is composed of a smooth-faced (56') press roll (56) fitted at the side of the rougher face (W_y) of the paper web (W) and of a smooth-faced hose roll (165) fitted inside the transfer-belt loop (50), operating against said press roll (56) and loaded by a press shoe or by a series of press shoes (210) (Fig. 3B).

8. A press section as claimed in claim 5, **characterized** in that the extended-nip equalizing press (NP_3) is composed of a hose roll (155) fitted inside the transfer-belt loop (50) and of a press roll (65) placed opposite to said hose roll (155) at the side of the rougher face (W_y) of the paper web (W), around which press roll (65) an equalizing-band loop (60) is fitted (Fig. 4A).

9. A press section as claimed in claim 5, **characterized** in that the extended-nip equalizing press (NP_3) is composed of a press roll (165) fitted inside the transfer-belt loop (50) and of a hose roll (155) fitted opposite to said press roll (165) at the side of the rougher face (W_y) of the paper web (W), around which hose. roll (155) an equalizing-band loop (60) is fitted (Fig. 4B).

10. A press section as claimed in any of the claims 1 to 9, **characterized** in that, between the last dewatering press nip (NP_1,N_2,NP_2) and the equalizing nip (N_3;NP_3), the running direction of said transfer-belt loop (50) is substantially horizontal, so that the paper web (W) is transferred on the top face of the transfer belt (50) as a substantially straight run from the last dewatering press nip (NP_2) to after the equalizing press nip (N_3,NP_3) and further as a straight run of substantially the same direction to the transfer zone (S), where the paper web (W) is transferred onto the drying wire (80) of the dryer section.

11. A press section of a paper machine, to which the paper web to be dewatered by pressing is brought from the former of the paper machine and from which the paper web (W) is passed to the dryer section of the paper machine, which press section comprises at least two separate press-nip zones (NP_1,NP_2), two press fabrics (20,30) that receive water running at least through the first one (NP_1) of said press-nip zones, between which press fabrics the paper web (W) runs through said nip zone, **characterized** in that the press section comprises a combination of:
press fabrics and a transfer belt (20,30,40,50) that have been fitted in such a way that the paper web (W) to be pressed has a closed and substantially straight draw supported by a press fabric from the

pick-up point (P) to the dryer section to the transfer point (S) without free unsupported draws,
a press-fabric press-roll assembly, which forms at least two separate press zones (NP_1,NP_2) which dewater the paper web (W) and between which the paper web (W) has said closed draw supported by a fabric or fabrics (30,40) of the assembly,
while at least one, preferably two, of said assemblies forms/form an extended-nip press zone (NP_1,NP_2), which is formed between a hose roll (25,55) or a band roll and an opposite press roll (35,145).

12. A press section as claimed in claim 11, **characterized** in that the press section comprises a combination of
a first upper fabric (20), which operates both as a pick-up fabric and as a press fabric in the first nip (NP_1),
a first lower fabric (30), which operates as the lower press fabric in the first nip (NP_1),
a second upper fabric (40), onto which the paper web (W) is transferred as a closed draw from the first lower fabric (30) as a suction-roll transfer (41a) or as an equivalent supported draw, and on which second upper fabric (40) the paper web (W) is transferred into the second dewatering nip (NP_2),
a transfer belt (50), which operates as the lower face in the second nip (NP_2), and on which transfer belt (50) the web (W) is passed through the equalizing nip (N_3, NP_3) and further to the dryer section as a closed substantially linear run.

13. A press section as claimed in any of the claims 1 to 12, **characterized** in that the temperature of the smooth press element placed against the rougher side (W_y) of the paper web (W) in the equalizing press nip (N_3;NP_3) has been raised in order to intensify the reduction of the roughness of said face of the paper web (W).

14. A press section as claimed in any of the claims 1 to 13, **characterized** in that the rougher side (W_y) of the paper web (W) is pressed in the equalizing press (N_3;NP_3) by means of a material whose hardness is higher than the hardness of the press material at the smoother side of the paper web (W).

15. A press section as claimed in any of the claims 1 to 14, **characterized** in that, in order to transfer the paper web (W) after the equalizing press nip (N_3;NP_3) from the transfer belt (50) onto the drying wire (80) of the dryer section, said drying wire (80) has been arranged to reach contact with the transfer-belt (50) guide roll (54a) over a certain sector (α), on which sector (α) the web (W) is transferred from the transfer belt (50) onto the drying wire (80), which wire is preferably the drying wire of the first group with single-wire draw in the dryer section.

16. A press section as claimed in claim 15, **characterized** in that said transfer sector (α) is arranged to be adjustable, by changing (V) the position of the drying-wire (80) guide roll (85), to a threading position, preferably to the range of $\alpha \approx 5°...45°$, and to a position of constant running, preferably to the range of $\alpha \approx 0°...15°$.

17. A press section as claimed in claim 15 or 16, **characterized** in that, after said transfer sector (α), the drying wire (80) and the paper web (W) placed on its support are passed over a reversing suction cylinder or roll (83a) provided with a grooved face (84) subjected to a vacuum onto the first drying cylinder (82) in the dryer section.

18. A press section as claimed in any of the claims 15 to 17, **characterized** in that, in order to prevent or to reduce formation of pressures that are induced in the closing nip space (NP) between the reversing cylinder (83a) and the drying wire (80) after said transfer sector (α) and that interfere with the support contact of the web (W), a blow box (86) has been fitted in connection with said nip space (NC).

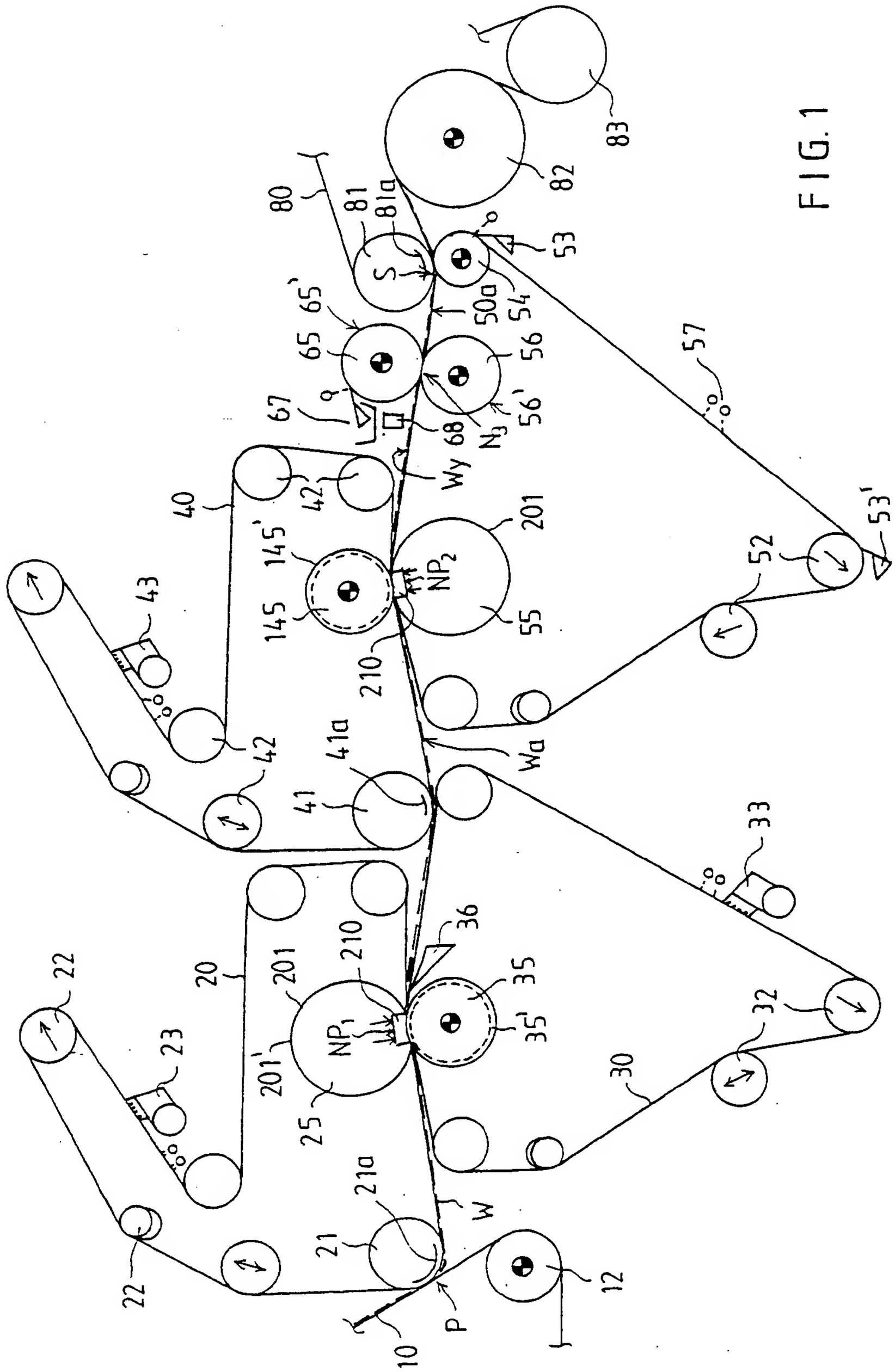

FIG.1

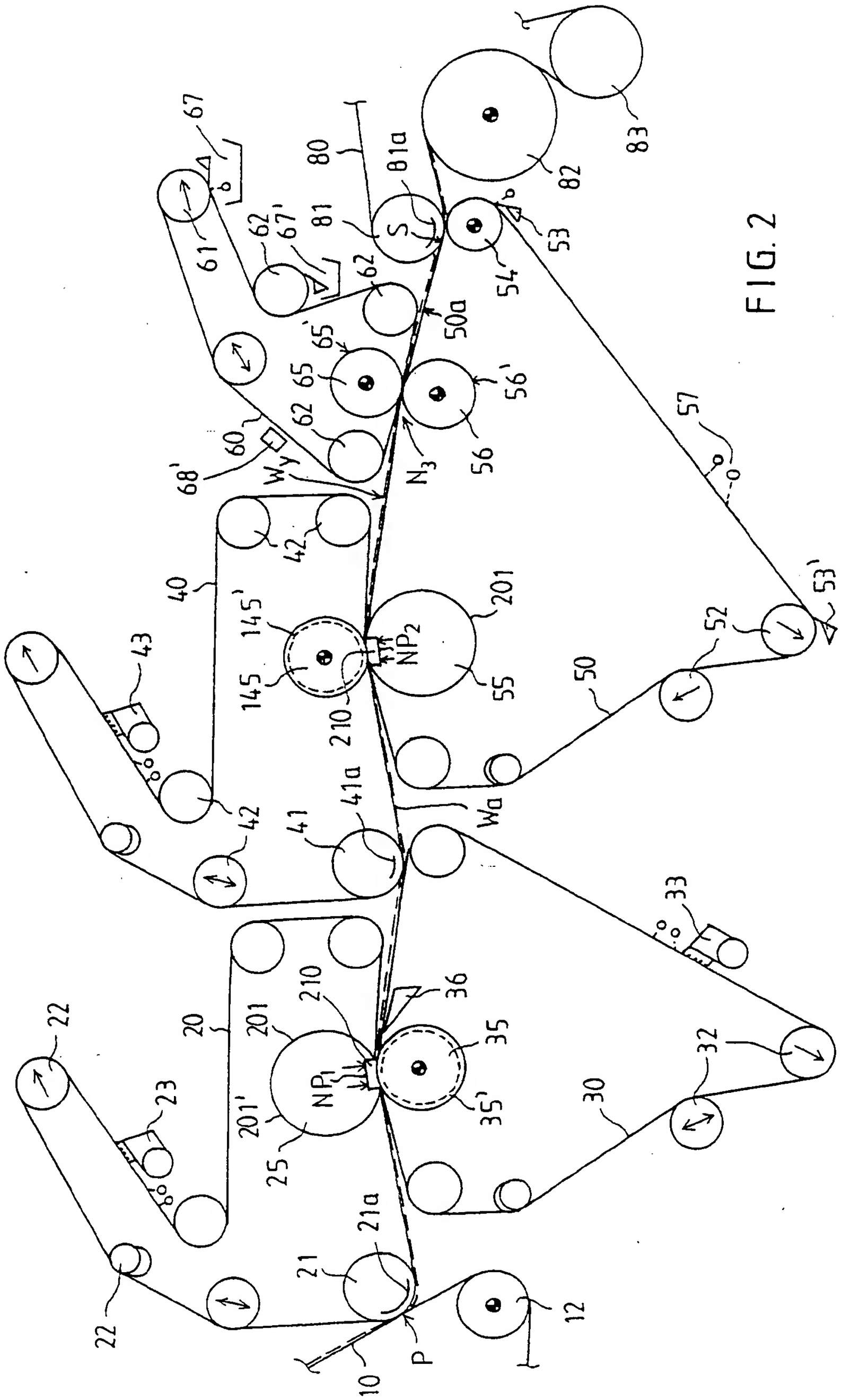

FIG. 2

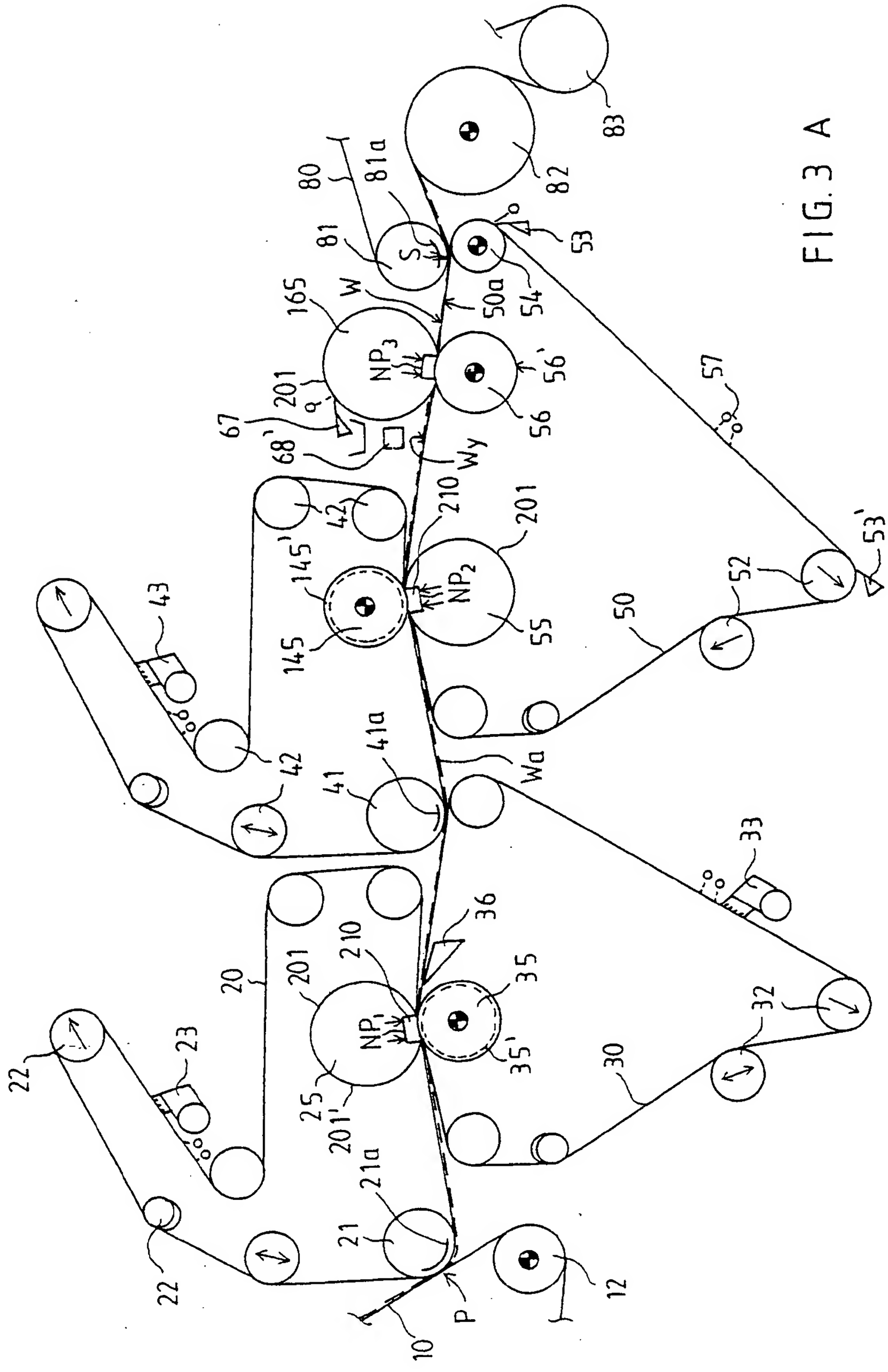

FIG. 3 A

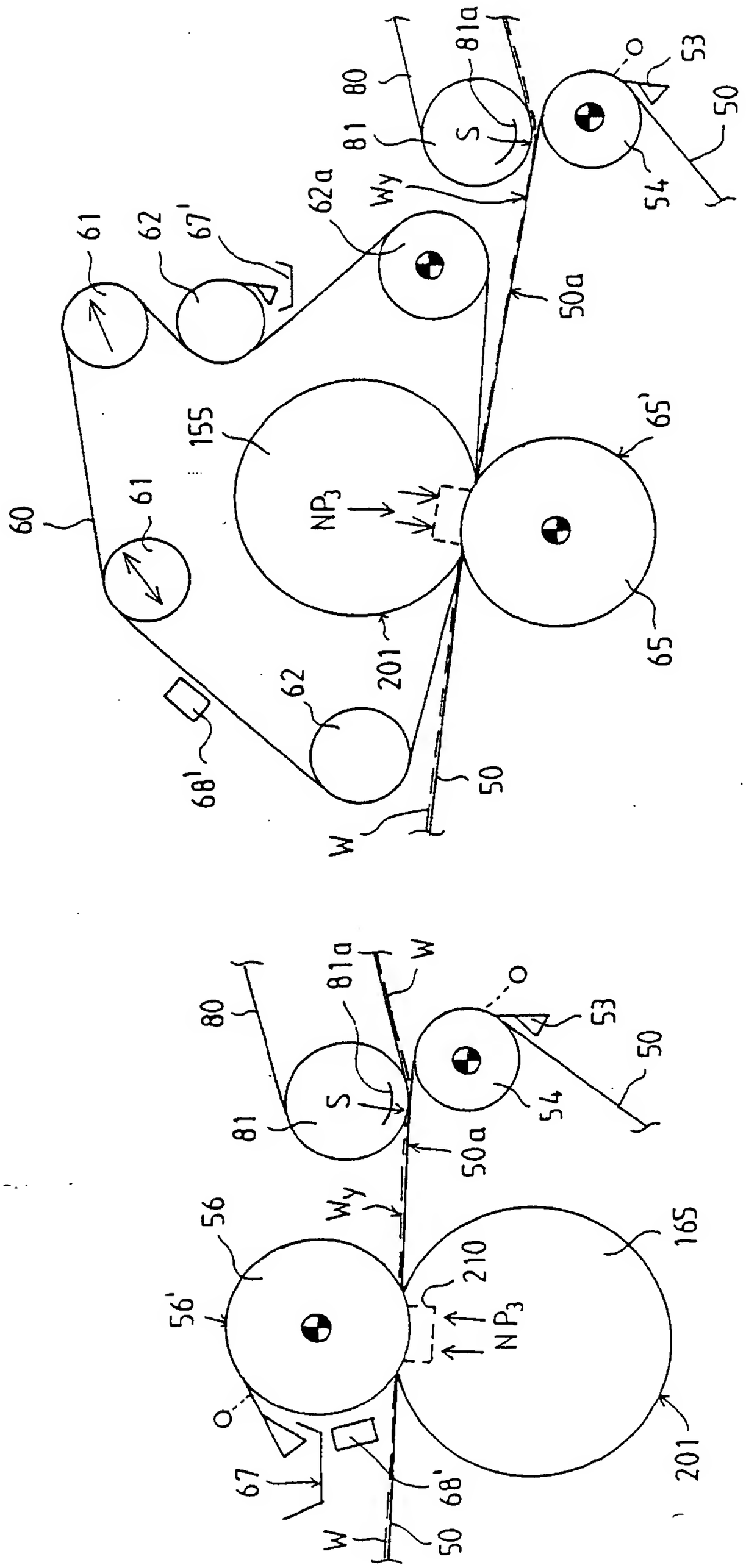

FIG. 4B

FIG. 3B

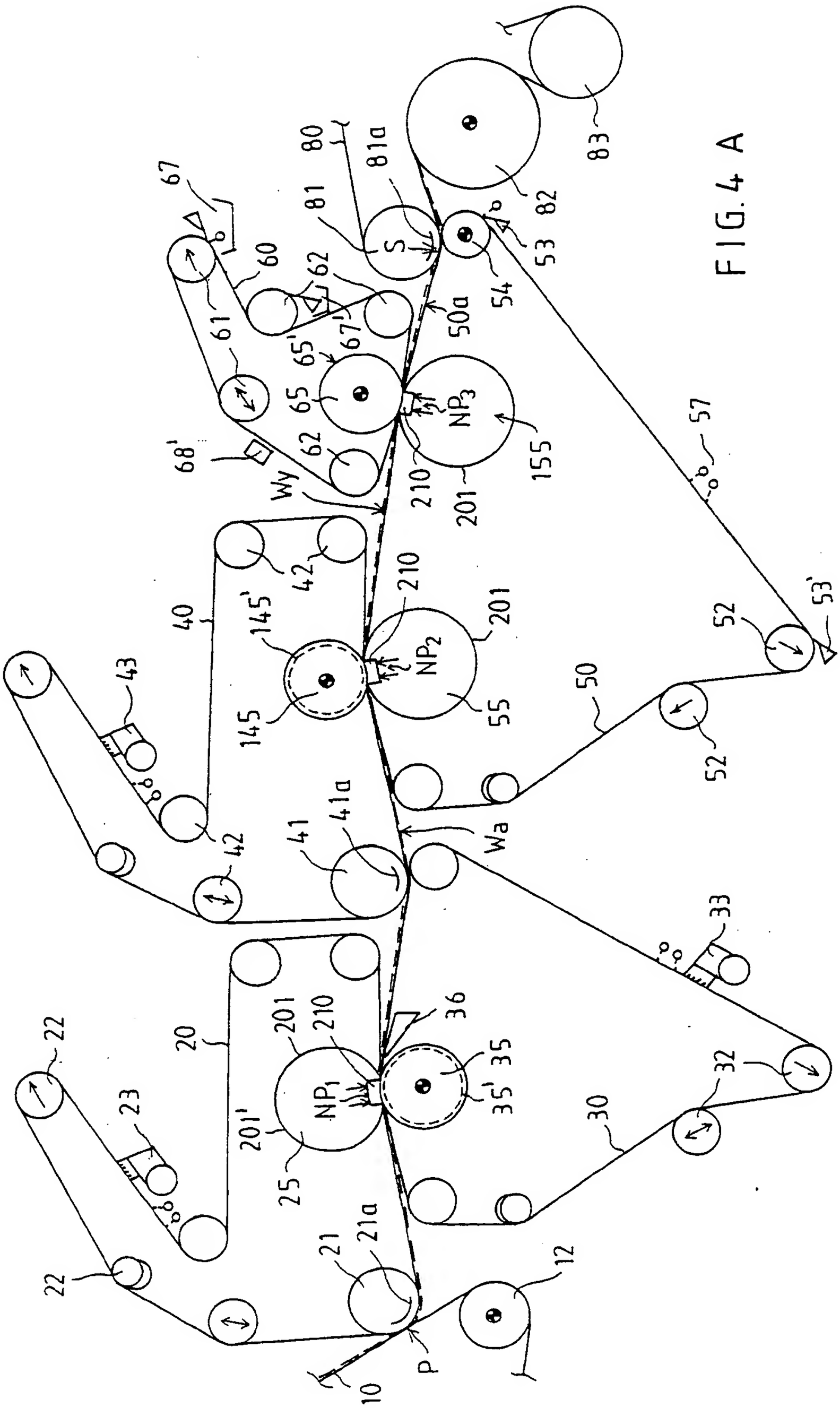

FIG. 4 A

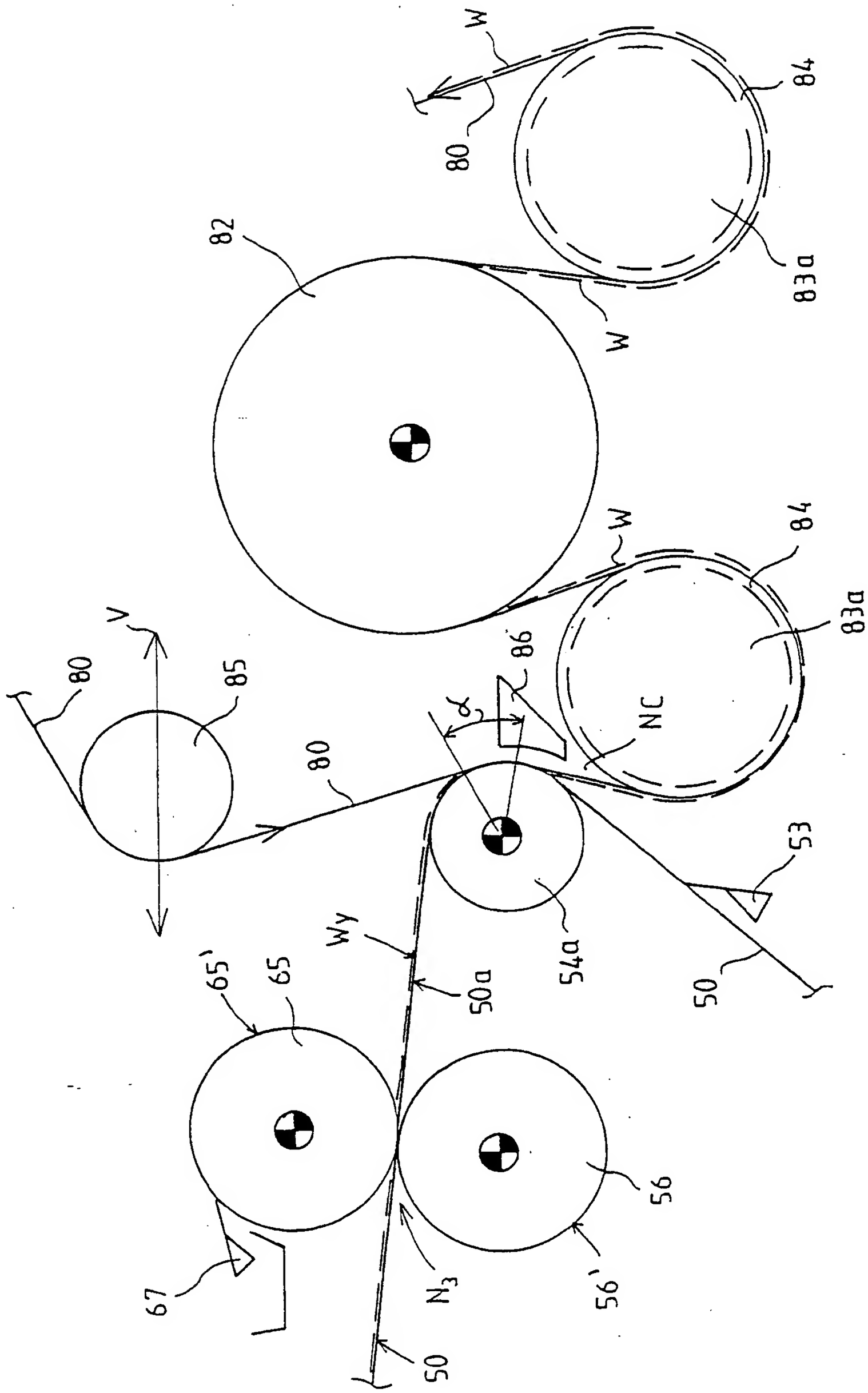

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 5338

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	DE-A-35 15 575 (VALMET OY) * the whole document * ---	11 1,2,10	D21F3/04
A	GB-A-2 127 448 (VALMET OY) * the whole document * ---	1,2, 10-12	
A	EP-A-0 487 483 (VALMET PAPER MACHINERY INC.) * the whole document * ---	1,2, 10-12	
D,A	DE-U-92 06 340 (SULZER-ESCHER WYSS) * the whole document * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	1 February 1996	De Rijck, F

EPO FORM 1503 03.82 (P04C01)

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